

REMARKS

By the foregoing amendments, claims 8 and 15 have been combined and claim 1 has been amended to be consistent with that change.

Claims 1, 2, 3, 8, 9 and 15-17 were rejected under 35 USC 103 over Sekijima or Kimura in view of Baghdadi. This rejection is respectfully traversed.

When single crystals are grown without using a seed crystal, the crystals grow in the same way as their nuclei which are naturally generated and function as the seed crystals and accordingly, the crystals have random orientations. Because the physical properties of the materials are dependent on their crystal orientations, it is important to grow crystals so as to have their intended orientation and this generally requires using a seed crystal in the method. The use of such seed crystals, however, makes the production process complicated.

It appears that the applicants have not been sufficient clear about the significance of the densest surface produced being in the free surface normal to the growth direction of the crystals. As pointed out in the third paragraph of page 3, when the densest (facet) surface appears in the free surface normal to the growth direction, the orientation of growth of the crystals has been controlled providing the desired single crystal orientation. When this characteristic is not achieved, the orientation of the growth of the crystals has not been controlled. Controlled orientation is desired and the prior art has used a seed crystal to achieve that result. The Examiner is correct that the use of seed involves an added cost. The prior art incurred that extra cost because the seed was necessary to achieve the desired result. The invention here is based on the discovery by the inventors that the extra cost could be avoided without sacrificing the desired result when the rod and the fiber-shaped single crystal were 3

mm or less in diameter. The prior art does not teach or suggest that the orientation of growth of the crystals could be controlled in the absence of the seed. The invention does so and that result is surprising and unexpected.

The Sekijima and Kimura references are representative of the prior art. They teach a process of manufacturing a single crystal using a seed crystal. As recognized by the Examiner, they do not teach eliminating the seed crystal. There is no teaching or suggestion in either of these references of controlling growth orientation, as reflected by the densest surface being in the free surface normal to the growth direction of the crystal, in the absence of seed.

The Baghdadi reference has been cited to show “a method of forming a monocrystalline material from a polycrystalline material without requiring the use of a seed crystal.” A simplification of a reference’s teachings for description purposes is improper when it crosses the line at which it becomes a modification of the disclosures of those references. See, e.g., *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 220 USPQ 97 (Fed. Cir. 1983). It is respectfully submitted that the characterization of Baghdadi just quoted does cross that line. While the references to “a” polycrystalline material and “a” monocrystalline material are literally true, they are also incomplete and misleading.

The Baghdadi reference relates to converting a polycrystalline semiconductor sheet to a monocrystalline semiconductor sheet through the device of using of a geometric restriction in the sheet. It does not relate to manufacturing a single crystal from a raw material polycrystalline rod. There is no motivation provided by the references for employing the sheet handling procedure of Baghdadi in any non-sheet procedure, including those of Sekijima or Kimura. The Office Action suggests motivation can be found in the high volume of Baghdadi but that suggestion assumes, without any basis, that the production volume of Sekijima or Kimura are inadequate

and are less than that of Baghdadadi. Without a factual basis, it is respectfully submitted that this proposed motivation is not valid.

The Office Action also suggests cost as the motivation. It is respectfully submitted that this is also not valid for two reasons. First, the cost of the seed was tolerated because it was necessary to achieve the desired orientation result. Nothing in Baghdadadi suggests the desired orientation can be realized in a different process without using the seed. Second, the cost to which Baghdadadi refers is not that of the seed. The reference teaches that the prior art process of growing an ingot of a single crystal semiconductor material which is thereafter sliced, lapped and polished to produce thin wafers is expensive and that a high volume, low cost alternative to the ingot process involves using a sheet material, forming a region of small width in the sheet material, heating the small width region and allowing a portion of the molten zone to solidifying into a seed crystal, etc. The absence of a seed crystal is not the reason for the high volume, low cost, but rather using a sheet as the initial material avoids the necessity of slicing, lapping and polishing an ingot.

Even assuming motivation was present (which it is not), the claimed invention is still patentable. Nothing in the references would lead one skilled in this art to expect the results to be different if form and dimensions were controlled. The examples in the present invention show that when the rod is 3 mm in diameter or less the desired orientation result is achieved but when the diameter is 4 mm, it is not. There is nothing in any of these references to suggest that growth will occur one way when the diameter is 3 mm or less and in a different way when the diameter is 4 mm or greater. The Office Action indicated this was not persuasive for two reason. First, it was pointed out that Sekijuma similarly used a 3 mm rod but in response, it is pointed out that this reference uses a seed to achieve the desired orientation. The second reason appears to be based on a misapprehension about the significance of the densest surface,

which has been clarified above. Avoiding a result that is not desirable is, of course, a significant event.

Claims 4 and 10 were rejected under 35 U.S.C. 103 over the same combination of references in further combination of Cordova-Plaza or Kobayashi. This rejection is also respectfully traversed.

The prior combination of references has been discussed above. The additional references have been cited only to show the laser heated pedestal growth method exists but those references are not asserted to, nor in fact do they, cure the basic deficiencies in the other references when combined. The further combination of these two references with the prior combination cannot therefore, render the claimed invention obvious.

In light of all of the forgoing considerations, it is respectfully submitted that this application is now in condition to be allowed and the early issuance of a Notice of Allowance is respectfully solicited.

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Respectfully submitted,

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